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REPORT

OF

THE DIRECTOR

OF THE

ROYAL OBSERVATORY, HONGKONG,

FOR THE YEAR

1921

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1922

REPORT OF THE DIRECTOR OF THE ROYAL OBSERVATORY, HONGKONG, FOR THE YEAR 1921.

I.—Grounds and Buildings.

The grounds were kept in order by the Botanical and Forestry Department with the assistance of the Observatory coolies.

The old magnetic hut was pulled down early in the year and quarters for the European assistants built on the site. They were completed in September.

II.—Meteorological Instruments.

Barometers.—The glass tube for the Marvin compensated syphon barometer was received in December and the instrument set up in February, 1922. The circuit for the seismograph minute time break apparatus is led through two contact springs on the face of the barograph clock. When the minute hand arrives at 59½ minutes it breaks this contact and makes contact for one minute through a third spring placed above the other two. The current instead of passing through the seismograph time-break coil thus passes through the coil of an electric hammer which time-scales the barogram every hour. Diverting the current from the seismograph at the 60th minute also serves to identify the minute breaks on the seismograms.

Beckley Anemograph.—This instrument was oiled and the orientation of the vane checked once a month.

Dines-Baxendell Anemograph.—The bearings of the vane were oiled and its orientation checked once a month. The spindle of the float was cleaned and oiled once a week. In November the instrument was carefully calibrated at low velocities by a pressure gauge constructed locally. The gauge was tilted about 80° from the vertical in order to obtain a measurable displacement of the water for a velocity as low as 5 miles an hour. The observations indicated that the float was too light; shot were therefore placed in the cup on the spindle until the float sank to the correct level. The criterion being that the line produced through the observations of the pressure gauge, plotted against the corresponding pressures read from the anemogram, should pass through the zero of the anemogram scale.

The mean monthly results of comparisons with the records of the Beckley Anemograph from 1910-1920 are given in the following table, together with the results for 1921.

Factor for converting the actual run of the Beckley Anemograph cups to velocities recorded by the Dines Pressure Tube Anemograph.

Month.	Factor (Dines $\div \frac{\text{Beckley}}{3}$).	
	Mean 1910-1920.	1921.
January, ...	1·87	1·49
February, ...	1·91	1·46
March, ...	1·93	1·60
April, ...	1·93	1·73
May, ...	1·99	1·69
June, ...	2·02	1·77
July, ...	2·08	1·92
August,....................	2·04	1·88
September, ...	2·03	1·83
October, ...	1·97	1·78
November, ...	1·89	1·83
December, ...	1·85	1·96
Year,.........	1·96	1·74

Gap Rock Anemograph.—This instrument was dismounted and brought to the Observatory to be overhauled in November. A leak in the float was repaired, the vane lightened and a vertical tail added, with "stream line" cross section as recommended by the London Meteorological Office.

Owing to its exposed position the vane was designed to withstand exceptionally heavy gales, with result that, owing to its weight, it was very sluggish. This caused erroneous records not only of direction but velocity also, as the true velocity is only recorded when the vane is pointing in the direction from which the wind blows. It follows that in estimating the amount of turbulence in the atmosphere from records of Dines Anemographs the sensibility of the vane must be taken into consideration, the alternate lulls and gusts shown on the anemograms being partly due to the vane not responding to changes of wind direction, and to the fact that the vane is continually oscillating on either side of the wind direction, only remaining parallel to the wind for a short time.

Thermometers.—All thermometers in use were compared with the Kew Standard in winter and summer.

Richard Thermograph.—This instrument worked satisfactorily during the year, though the base lines as laid down from the hourly eye observations of rotating thermometers still show irregularities, except on dull days with small range of temperature. The period during which the fan automatically aspirates the thermometers has been further increased to 5 minutes *i.e.* from the 55th to the 60th minute of each hour. The effect of the fan on the dry and wet bulb readings for the year 1921 is being measured. The results may modify the figures given on page 16 of the 1918 report.

III.—METEOROLOGICAL OBSERVATION AT THE OBSERVATORY.

Automatic records of the temperature of the air and evaporation were obtained with a Richard dry and wet bulb thermograph, and of the direction and velocity of the wind with a Beckley and a Dines-Baxendell anemograph, modified as described in the report for 1912. The amount of rain is recorded automatically by a Nakamura pluviograph, the amount of sunshine by two Campbell-Stokes universal sunshine recorders, and the relative humidity of the air by a small Richard hair hygrograph. Eye observations of barometric pressure, temperature of the air and of evaporation and the amount of cloud are made at each hour of Hongkong Standard time. The character and direction of the motion of the clouds are observed every three hours. Daily readings are taken of self-registering maximum and minimum thermometers.

Principal features of the Weather.—The principal features of the weather in 1921 were:—

(*a*) Heavy rainfall from April 27 to July 6, during which period 59 inches of rain fell on 59 days; and a drought from September 9 to the end of the year when only 1 inch of rain fell.

(*b*) Abnormally low wind velocity in March, increasing gradually to normal in July.

Barometric pressure was considerably above normal in January, July and October, and considerably below in May, June and August. The mean pressure for the year at station level was 29·848$^{\text{ins.}}$ as against 29·814$^{\text{ins.}}$ in 1920 and 29·843$^{\text{ins.}}$ for the past 38 years. The highest pressure was 30·323$^{\text{ins.}}$ on January 14 as against 30·374$^{\text{ins.}}$ in 1920 and 30·509$^{\text{ins.}}$ for the past 38 years. The lowest pressure was 29·319$^{\text{ins.}}$ on July 24, as against 29·208$^{\text{ins.}}$ in 1920 and 28·735$^{\text{ins.}}$ for the past 38 years.

The temperature of the air was moderately above normal in February, March, April, August and December and moderately below in January. The mean temperature for the year was 72°·2 as against 72°·0 in 1920 and 71°·8 for the past 38 years. The highest temperature was 92°·2 on August 22 as against 93°·1 in 1920 and 97°·0 for the past 38 years. The lowest temperature was 44°·0 on February 4 as against 45°·1 in 1920 and 32°·0 for the past 38 years.

The rainfall was very considerably above normal in May and moderately above normal in March, August and September. It was considerably below normal in April, October, November and December. The total for the year was 97·34$^{\text{ins.}}$ as against 107·88$^{\text{ins.}}$ in 1920, and 84·02$^{\text{ins.}}$ for the past 38 years. The greatest fall in one civil day was 6·06$^{\text{ins.}}$ on September 3 and the greatest in one hour was 3·25$^{\text{ins.}}$ between 1.30 p.m. and 2.30 p.m. on May 31.

The wind velocity was considerably below normal in January, March, April, May and October. In July it was normal and in the remaining months it was slightly below normal. The mean velocity for the year was 10·7 m.p.h. as against 12·0 m.p.h. in 1920 and 12·7 m.p.h. for the past 38 years. The maximum velocity for one hour, as recorded by the Beckley Anemograph, was 51 miles at 11 a.m. on July 24 as against 51 miles in 1920 and 108 for the past 38 years. The maximum squall velocity, as recorded by the Dines-Baxendell Anemograph, was at the rate of 69 m.p.h. at *5h. 53m.* a.m. on September 3 as against 61 m.p.h. in 1920 and 105 m.p.h. for the past 12 years.

Rainfall at Four Stations.—In the following table the monthly rainfall for the year 1921 at the Observatory is compared with the fall at the Police Station, Taipo; the Botanical Gardens; and the Matilda Hospital, Mount Kellet:—

Months.	Observatory (*Kowloon*).	Police Station (*Taipo*).	Botanical Gardens (*Hongkong*).	Matilda Hospital (*Hongkong*).
	inches.	*inches.*	*inches.*	*inches.*
January, ...	0·195	0·19	0·28	0·31
February, ...	1·040	1·48	1·20	0·80
March, ...	4·505	5·70	4·74	3·74
April, ...	2·820	2·70	3·01	2·95
May, ...	33·785	35·49	33·50	29·67
June, ...	14·740	20·32	16·59	19·83
July, ...	11·875	15·47	13·88	11·30
August, ...	15·445	15·27	15·95	12·95
September,...	12·100	16·31	15·77	10·49
October, ...	0·395	0·80	0·15	0·24
November, ...	0·220	0·88	2·43	0·25
December, ...	0.220	0·02	0·33	0·32
Year,...	97·340	114·63	107·83	92·85

Floods.—The heaviest rainfall occurred at the Observatory as follows:—

Period.							*Amount.*	*Duration.*	*Greatest fall in 1 hour.* — *Amount.*	*Time.*		
	d.	h.			d.	h.	inches.	hours.	inches.		d.	h.
May...	4	23	to	May	5	23	4·14	23	1·04	May...	4	23
May...	9	10	to	May	10	13	5·10	17	2·00	May...	9	16
May...	14	12	to	May	18	6	6·56	46	1·76	May...	17	12
May...	22	6	to	May	28	4	13·10	74	1·56	May...	24	4
May...	31	13	to	May	31	16	3·51	3	3·25	May...	31	14
June	29	9	to	July	6	21	10·43	47	1·23	July...	2	13
Aug...	24	4	to	Aug.	26	18	6·09	18	1·52	Aug...	26	14
Aug...	30	2	to	Sept.	7	14	16·38	69	1·08	Aug...	30	8

Typhoons.—The tracks of 21 typhoons and 11 of the principal depressions which occurred in the Far East in 1921 are given in two plates in the Monthly Meteorological Bulletin for December 1921.

The Captain of the S. S. *Anamba* reports a typhoon in latitude 15°·23′ N. and longitude 110°·33′ E. on July 16. The wind veered from N at 10 p.m. on the 15th to SE by 6 a.m. on the 16th and SSW by 8 a.m. The force increased from 1 at 4 p.m. on the 15th to 11 at 4 a.m. on the 16th and then decreased to 7 by 9 a.m. A note adds that the vessel drifted approximately N 29° E 44 miles in the typhoon. The Euryalus, 120 miles to the northward, had a steady barometer with light to moderate ENE winds.

On July 22 a secondary formed in the southern portion of a depression to the east of Luzon which was travelling northward. The secondary moved westward and passed near Pakhoi on July 25. It caused a gale at Hongkong on July 24.

On September 2 a secondary formed in the north-east portion of a depression in the China Sea, whose direction of motion was uncertain. The secondary developed into a typhoon and caused a gale at Hongkong. It filled up near Woochow on September 3.

The attention of meteorologists is drawn to these three typhoons. No indication of the first was shown on the weather map. This Observatory had no knowledge of its existence till nearly 8 months later, when the log of the *Anamba* was received by the courtesy of the Director of the Philippines Weather Bureau. Its track is very uncertain. It was evidently short lived and of small diameter. Both of the others absorbed the primary cyclone, and one formed in the southern portion of it while the other formed in the north-east portion. They were evidently analogous to the typhoon which caused so much damage to Hongkong on September 18, 1906.

The formation of these secondaries in the China Sea, where there are no observing stations, adds to the difficulty of the weather forecaster, and emphasises the importance of wireless weather telegrams from ships. In their own interests every vessel with a wireless outfit should send observations in accordance with the Notice to Mariners which is supplied to all shipping companies in Hongkong.

IV.—Publications.

Daily Weather Report and Map.—A weather map of the Far East for 6 a.m. of the 120th meridian, and the Daily Weather Report (containing meteorological observations, usually at 6*h*. and 14*h*., from about 40 stations in China, Indo-China, Japan, the Philippines, and Borneo) and daily weather forecasts for Hongkong to Gap Rock, the Formosa Channel, the south coast of China between Hongkong and Lamocks, and between Hongkong and Hainan, were issued as in former years. Copies of the map were exhibited on notice boards at the Hongkong Ferry Piers, Blake Pier, and the Harbour Office. One copy was sent daily to the Director of the Meteorological Observatory, Macao. Forty copies of the Daily Weather Report were distributed to various offices, etc., in the Colony, and a copy was sent daily to the Director of the Meteorological Observatory, Macao. Copies were sent every week to the Hydrographic Office, Bangkok.

The question of publishing the Daily Weather Report and Map in the "Daily Bulletin" (a local publication devoted principally to cable news) was raised, but as it required a high speed and costly lithographic plant at the Observatory, the project was left in abeyance.

A charge of $10 a year is made for supplying private firms and individuals with the Daily Weather Report, and $36 for the Weather Map. No maps were published on January 23, 24 and 26, February 27, March 11, and May 15, owing to the late arrival of the weather telegrams. On several other occasions the map, though published, contained but meagre information.

The weather forecast is telegraphed daily to the Cape d'Aguilar Wireless Station in time for distribution at 1 p.m. It is broadcast again at 5 p.m.

Monthly Meteorological Bulletin.—The Monthly Meteorological Bulletin, which includes the Daily Weather Report, was published as usual, and distributed to the principal observatories and scientific institutions in different parts of the world.

Monthly Seismological Bulletin.—The publication of a monthly seismological bulletin, giving particulars of earthquakes recorded by the Milne-Shaw seismograph, was commenced in October.

Miscellaneous Returns.—A monthly abstract of observations made at the Observatory is published in the Government Gazette, and daily, monthly, and yearly results are published in the Blue Book in the form suggested by the London Meteorological Office for the British Colonies. The monthly departures from normal of the barometric pressure at four China Coast Ports are communicated to the Commonwealth Meteorologist, Melbourne, in connection with long range weather forecasts. Monthly meteorological returns are forwarded to the Meteorological Magazine, and annual returns to the Stock Exchange Official Intelligence, the Colonial Office List, and Whitaker's Almanack.

V.—Weather Telegrams, Forecasts, and Storm Warnings.

Daily Weather Telegrams.—The improvement in this service mentioned last year continues, but occasionally the observations from Japan and Indo-China still arrive too late for insertion in the Daily Weather Map.

A welcome addition to the list of reporting stations is Yap, in longitude 138°·08′ E and latitude 9°·29′ N. Through the courtesy of the Director of the Philippines Weather Bureau observations from this station have been received since March 23, except when communication has been interrupted. While on a visit to the Zikawei Observatory in the Spring the Director discussed with Father Froc the possibility of obtaining daily weather telegrams from Hankow. Owing however to unforeseen difficulties the service has not yet commenced. Occasionally belated weather telegrams are received from Central and South China, but as a rule the observations from these districts are posted in batches to Hongkong. The prompt receipt of telegrams from these districts would be of great assistance in weather forecasting, particularly in the winter months.

Extra Weather Telegrams. The following stations send extra weather telegrams at half rates during typhoons, on receipt of certain code words from Hongkong:—Amoy, Canton, Macao, Phulien, Sharp Peak, and Taihoku. The Director of the Philippines Weather Bureau also sends extra telegrams, at his discretion, from Aparri or some other station nearer the typhoon centre. The extra 9 p.m. telegram, from Swatow, kindly sanctioned by the Chinese Telegraph Administration during the typhoon season, was seldom received.

Wireless Weather Telegrams. There has been but a poor response to the Marconi Company's circular and the Observatory Notice to Mariners respecting wireless weather telegrams referred to in the 1919 report. Less than 10% of the ships within range sent weather telegrams to the Observatory during the year.

The following table gives the monthly number of ships, of different nationalities, from which wireless meteorological messages have been received, and the number of messages received, (each arrival and departure is counted separately).

Month.	*British (including H.M. Ships).*		*Dutch.*		*Japanese.*		*Other Nationalities.*	
	No. of ships.	No. of messages.	No. of ships.	No. of messages.	No. of ships.	No. of messages.	No. of ships.	No. of messages.
January, ...	3	6	2	3	1	1	1	1
February, ...	4	5	5	5	3	8	...	...
March, ...	3	8	5	5	1	1	...	...
April, ...	6	12	2	3	1	1	...	...
May, ...	8	15	4	4	5	7	6	7
June, ...	12	22	6	13	4	7	7	13
July, ...	19	40	10	20	5	8	3	4
August, ...	12	23	8	11	5	9	2	4
September, ..	16	46	14	26	3	6	1	1
October, ...	14	32	6	9	2	4	...	...
November, ...	12	27	12	17	6	16	1	1
December, ...	12	31	10	14	4	9	...	...
Totals 1921,...	121	...	84	...	40	...	21	...
Totals 1920,...	64	...	48	...	25	...	3	...
Totals 1919,...	17	...	36	...	6	...	2	...
Totals 1918,...	...	...	41	...	14	...	...	...
Totals 1917,...	...	...	93	...	37	...	...	...
Totals 1916,...	...	...	95	...	60	...	...	...

Results of Weather Forecasts.—The results of the comparison of the daily weather forecasts with the weather subsequently experienced are given below, with the results of the previous five years:—

Year.	Complete Success.	Partial Success.	Partial Failure.	Total Failure.
	%	%	%	%
1916	67	29	3	1
1917	67	29	4	0
1918	71	26	3	0
1919	71	27	2	0
1920	64	30	5	1
1921	65	30	5	0

No forecasts were issued on January 23, 24, 26, February 27 and March 11, owing to lack of telegraphic information.

The forecast comprises wind direction, wind force, and weather.

Complete success means correct in three elements. Partial success means correct in only two elements. Partial failure means correct in only one element. Total failure means correct in no element.

The method of analysis is described in the 1918 Report.

Storm Warnings.—At the request of the Chamber of Commerce the Hongkong Government adopted the China Seas Storm Signal Code from 1920, June 1, in place of the Hongkong Non-Local Code introduced in 1917. The signals are displayed on Kowloon Signal Hill.

The following Ports are warned by a telegraphic adaptation of the code:—Sharp Peak, Swatow, Amoy, Santuao, Macao, Canton, Wuchow, Pakhoi, Hoihow, Phulien, Taihoku, Manila, Labuan, and Singapore. 87 storm warnings were sent in 1921 and 122 were received from Manila. 10 were received from Phulien, *via* Quang Chau Wan Radio Station.

Local typhoon signals are exhibited on the Observatory wireless mast and repeated at the Harbour Office, H.M.S. *Tamar*, Green Island, the Godown Company, (Kowloon), Lyemun, and Lai Chi Lok, during the day.

The local night signals are exhibited on the Observatory Wireless Mast and repeated on the tower of the Kowloon Railway Station, on H.M.S. *Tamar*, and at the Harbour Office.

A translation of the non-local and local storm warnings is exhibited at the Harbour Office, the General Post Office and the Star Ferry Piers and also sent to the Cape d'Aguilar Wireless station, which broadcasts the message at about noon and repeats it every two hours until midnight. If a second warning is issued during the day, the later warning is substituted.

When a local storm warning is displayed at the Observatory a cone is exhibited at several outlying stations for the benefit of native craft and passing ocean vessels.

In the following table is given the number of hours the local signals were hoisted in each of the years 1912-1921.

Year.	Red Signals.	Black Signals.	Bombs.*
	Number of hours hoisted.		Number of times fired.
1912	151	164	...
1913	146	189	1
1914	140	178	
1915	64	120	
1916	78	201	1
1917	102	36	
1918	33	172	1
1919	78	183	1
1920	107	156	
1921	94	121	

The figures in the above table include the number of hours that night signals, corresponding to the day signals, were hoisted.

The red signals indicate that a depression exists which may cause a gale at Hongkong within 24 hours. The black signals indicate that a gale is expected at Hongkong.

Prior to July 1917, the red signals indicated that the centre of the typhoon was believed to be more than 300 miles distant, and the black less than 300 miles; the returns for 1912-1916 are therefore not strictly comparable with those for 1917-1921.

VI. METEOROLOGICAL OBSERVATIONS FROM SHIPS

TREATY PORTS, &c.

Logs received.—In addition to meteorological registers kept at about 40 stations in China, meteorological logs were received from 168 ships operating in the Far East. These logs, representing 5662 days' observations have been utilised for verifying typhoon tracks. The corresponding figures for the year 1920 were 170 and 5872.

Comparison of Barometers.—The corrections to ships' barometers are usually obtained by comparing their readings while at Hongkong with those of the Observatory Standard. Occasionally ship captains bring their barometers to the Observatory to be compared with the Observatory Standard.

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* Three bombs fired at intervals of 10 seconds indicate that wind of typhoon force is anticipated.

VII. MAGNETIC OBSERVATIONS.

Magnetic observations were resumed in the new hut in October, the quarters on the site of the old hut having been completed in September.

In the following table the results of observations made with magnetometer Elliott 83 and dip circle Dover 71 in the new hut, for the epoch 1921.9, are compared with the values extrapolated from the observations made with Elliott 55 and Dover 71 in the old hut.

	Observed in new hut with magnet 83 in unifilar 83 and dip circle 71	*Extrapolated from observations in old hut with magnet 55 A in unifilar 55 and dip circle 71.*	
	(a)	*(b)*	*(b − a)*
	′	′	′
Declination (west)	0 19·8	0 22·6	2·8
Dip (north)	30 45·8	30 45·0	0·8
Horizontal Force (C. G. S. unit)	0·37295	0·37190	·00105
Vertical Force (C. G. S. unit)	0·22199	0·22125	·00074
Total Force (C. G. S. unit)...	0·43402	0·43276	·00126

The quantities in the last column should therefore be applied to observations with Elliott 83 and Dover 71 in the new hut, to reduce them to the 1884-1920 series of observations.

VIII. TIME SERVICE.

Time Ball.- Prior to 1920, January 1, the Time Ball on Kowloon Signal Hill was dropped daily at 1 p.m. (120th Meridian Time). It is now dropped at 10 a.m. and 4 p.m. daily, except on Saturdays when it is dropped at 10 a.m. and 1 p.m., and on Sundays and Holidays when it is dropped at 10 a.m. only.

The Ball is hoisted half mast at the 55th minute and full mast at the 57th minute. If the ball fails to drop at the correct time it is lowered at 5 minutes past the hour and the ordinary routine repeated at the following hour, if possible.

When the Time Ball is out of order the above routine is carried out with flag "z", on the storm signal mast.

Time Signals are also given at night by means of three white lamps mounted vertically on the Observatory wireless mast. From *8h. 56m. 0s.* to *9h. 0m. 0s.* p.m. the lamps are extinguished momentarily at the even seconds, except at the 2nd, 28th, 50th, 52nd, and 54th of each minute. The hours refer to Hongkong Standard Time (8 hours East of Greenwich).

The Ball was dropped successfully 657 times. There were 5 failures attributable to electrical or mechanical defects, and on three occasions the ball was not raised owing to the prevalence of high winds.

The days on which the ball failed to drop were:— April 14 (10h.), April 15 (16h.), April 16, (10h. and 11h.) and November 25 (10h.).

In the following table is given the number of times different errors occurred in the years 1920 and 1921.

Error.	Number of Times.	
	1920	1921
0·3 sec. or less	562	573
0·4 ..	61	54
0·5 ..	13	11
0·6 ..	1[illegible]	12
0·7	[illegible]	6
0·8 ..	...	4
0·9 ..	1	2
1·0 ..	1	4
1·1 ..	...	[illegible]
1·3 ..		[illegible]
1·5 ..	1	[illegible]
1·6 ..	...	[illegible]
1·8 ..	...	[illegible]
2·[illegible] ..		1

The mean probable error of the time ball in each month for the past five years is given in the following table:—

Month.	Probable Error of the Time Ball.				
	1917	1918	1919	1920	1921
January, ...	±0·17	±0·11	±0·24	±0·17	±0·2[illegible]
February, ...	·1[illegible]	·13	·20	·3[illegible]	·13
March, ...	·11	·15	·12	·21	·44
April, ...	·18	·1[illegible]	·19	·15	·27
May, ...	·17	·12	·14	·17	·16
June, ...	·10	·14	·14	·13	·17
July, ...	·21	·11	·13	·22	·1[illegible]
August, ...	·11	·26	·15	·11	·1[illegible]
September, ...	·1[illegible]	·16	·1[illegible]	·24	·2[illegible]
October, ...	·10	·12	·13	·15	·1[illegible]
November, ...	·1[illegible]	·12	·14	·19	·1[illegible]
December, ...	·10	·14	·12	·13	·11
Means, ...	±0·15	±0·14	±0·15	±0·18	±0·18

Time Signals by Wireless Telegraphy.—In addition to the time signals given by the Time Ball, and on the wireless mast, signals are sent at 10h. and 21h. by wireless telegraphy *via* Stonecutters. Particulars of the programme are given in the 1918 Report and in Government Notification No. 452 of 12.3.21. The service was transferred from Cape d'Aguilar to Stonecutters on May 1, 1921.

Wireless Receiving Set.—The existing set was dismounted on September 15 and re-wired, with additional apparatus, by the Superintendent of Wireless Telegraphy on December 8. With the new set the Manila time signals on a 5,000 metre arc are heard distinctly. Also the Funabashi signals. Those from Shanghai are still inaudible, though Mr. Bradshaw hopes to be able to pick them up soon.

Transit Instrument.—Observations for time were made daily with the 3-inch transit instrument and the Hipp tape chronograph by the Chinese computers, weather permitting.

The number of observations in the years 1920 and 1921 were as follows :

	1920	*1921*
Transits, ...	985	1,502
Level determination, ...	557	869
Azimuth, ...	20	50
Collimation, ...	20	37

Transits of the Sun were utilized occasionally during 1921.

A new reticule with darker, more distinct transit lines was received from England on August 5. It was put in place the same day and the transit line intervals determined. The lines were ruled with appreciable asymmetry to prevent any possibility of bias in observing.

The azimuth and collimation determinations were made by the Chief and First Assistants from observations of the old south mark. The error so obtained was checked occasionally by observations of polar stars.

Clocks.—The Standard Sidereal clock, Dent No. 39741, was cleaned and oiled on January 13. From this date its losing rate varied from −1·12 secs. on May 31 (Barometer 29^{ins} ·58 Temperature 78°.5) and June 18 (Barometer 29^{ins} ·42 Temperature 82°.5) to −0·25 sec. on December 5 (Barometer 30^{ins} ·15 Temperature 67 ·1).

The rate during cloudy periods was usually derived from the formula :—

$$r = -0s{\cdot}792 + 0s{\cdot}575\,(b\text{-}29\ \textit{ins.}) + 0s{\cdot}00021\,(t\text{-}50\ )$$

where r is the computed losing rate, and b and t the mean barometric pressure and temperature, respectively, for the preceding 24 hours.

In the following table is given the excess of the observed over the computed error after fairly long periods during 1921 :—

Date 1921.	Interval without observations.	Excess of observed over computed error.
		secs.
February 17, ...	2 days	— [illegible]
March [illegible], ...	[illegible]	+ [illegible]
April 1, ...	12 ..	— 1·[illegible]
.. 30, ...	4 ..	+ [illegible]
May 21, ...	[illegible] ..	— 0·22
.. 29, ...	[illegible] ..	+ [illegible]
June 6, ...	3 ..	+ [illegible]
.. 21, ...	[illegible] ..	[illegible]
July 4, ...	4 ..	+ [illegible]
.. 25, ...	3 ..	+ [illegible]
August 13, ...	7 ..	— [illegible]
September 6, ...	[illegible] ..	+ [illegible]
November 21, ...	4 ..	+ [illegible]
December 21, ...	5 ..	[illegible]

The Dent Mean Time clock (No. 39710) was used throughout the year for dropping the Time Ball, maintaining the electric time service in the Observatory, and sending hourly signals to the Railway, the Post Office, the Telephone Co., and the Eastern Extension Telegraph Co. The clock is corrected daily before 10 a.m. and before 4 p.m. by the electric regulating apparatus. Its daily rate is kept below 0·5 sec. by the addition or removal of weights from the pendulum.

Chronometer Dent No. 10917 is on loan to the Cape d'Aguilar Wireless Station, and chronometer Dent No. 39346 to the Peak Signal Station.

Batteries, Power Supply, &c. The necessary current for the Time Service has been supplied by accumulator batteries, charged as found necessary from the alternating mains of the China Light & Power Co., Ld., by a rotary converter.

IX.—MISCELLANEOUS.

Seismograph Installation.—One component of the Milne-Shaw Seismograph was received on September 26 and set up on a temporary mounting the next day.

The minute signal sent by the mean time clock for time scaling the records was found to be too short to make a perceptible break in the photographic record, a dash pot was therefore fitted to the eclipsing shutter. Its final form, as constructed by Mr. Evans, is similar in action to the piston in an oil force pump. It allows a sharp forward movement of the shutter with a slow backward movement. The duration of the eclipse is regulated by a light spiral spring on the horizontal arm of the dash pot. 5 seconds is found sufficient. A slot is cut in the shutter so as to make only a partial eclipse, thus avoiding loss of register while making a sufficient break to mark the minutes. This idea is due to Mr. J. J. Shaw. The minutes are identified by leading the circuit through contact springs on the face of the barograph clock, the minute hand of which breaks the contact at the 60th minute, as explained on page 1.

The instrument is provided with a fixed mirror for producing a base line ; a necessary adjunct for investigating diurnal and secular changes of level.

With its present mounting diurnal tilting of the instrument is very marked, following more closely the external than the internal temperature. This indicates that the movement is due to tilting of the stone pillar on which the instrument is mounted rather than to a temperature effect on the instrument.

37 earthquakes were recorded from September 26 to December 31. Of these 5 were felt as slight shocks locally and 5 others were apparently of local origin, though unfelt.

Meteorological Observations at Victoria Peak.—Meteorological observations at Victoria Peak were commenced in June by Mr. C. H. Cotton, who succeeded Mr. MacGrann as Officer in Charge of the Peak Signal Station.

Mr. Cotton seems to have had considerable difficulty in keeping the Anemograph and thermograph in order. The hourly time signals from the Observatory have failed repeatedly and much register has been lost.

Observations made with rotating thermometers at 8h., 10h., noon 14h., and 16h. daily, indicate that in June the temperature of the air at Victoria Peak during the day was 8° F. lower than at the Observatory, Kowloon, and 3° lower in December. The temperature of evaporation was 4° lower in June and 5° higher in November. The relative humidity was 16% higher in June and 42% higher in November.

Atmospherics.—The intensity of atmospherics was recorded by the operators at Stonecutters Naval Radio-Station 13 times daily, throughout the year, on a scale of 0 to 4, and curves have been prepared showing the annual inequality and the mean diurnal inequality in each month.

The maximum intensity, 2·92, occurred in May, with a secondary maximum, 2·35, at the end of August, and the minimum, 1·50, in December.

As regards diurnal inequality the maximum intensities occurred at midnight in the spring and autumn, at 3 a.m. in the summer, and at 2 a.m. in the winter. The minimum intensity occurred at 10 a.m. in the spring and winter and at 9 a.m. in the summer and autumn.

The times are approximate and refer to Hongkong Standard Time (8 hours East of Greenwich).

Arrangements have been made for the hourly observation at the Cape d'Aguilar Radio Station of the intensity and type of atmospherics also the wave on which they reach a maximum. It is hoped that these observations will be of service to the Radio Research Board and will determine whether systematic observation of atmospherics can be utilised for weather forecasting.

Upper Air Research.—2 theodolites, slide rules, hydrogen and pilot balloons for upper air research were received in May, and 19 ascents made between June 10 and September 21. The longest flight was 70 minutes on July 11. The results of the observations have been communicated to the International Commission for the investigation of the upper air.

The military Authorities have been approached with a view to obtaining the assistance of two N.C.O.s from the Corps of Royal Engineers, in order that the balloons may be observed simultaneously with two theodolites, one at the Observatory and one on the Signal Hill, Kowloon. Observation with only one theodolite necessitates the assumption that the rate of ascent can be computed from the weight and free lift of the balloon, and that it remains constant; whereas simultaneous observations with two theodolites, one at each end of a base line, furnish data for the computation of the height of the balloon at each observation.

It was thought advisable to ascertain how far the assumptions necessitated by the one theodolite method are justified in Hongkong before continuing the ascents. The rate of ascent is of course affected by vertical currents, and accumulation of data by the two theodolite method may show that in certain types of weather the single theodolite method will suffice and that in certain other types the single theodolite method should not be used.

Up to the present only two balloons have been found defective. This is gratifying as it was feared they might suffer from the voyage and climate.

The Winds of Hongkong.—A memoir on the winds of Hongkong was completed during the year and will be published shortly.

Visit to Other Observatories.—In the Spring the Director visited the Observatories at Shanghai, Kobe, Tokio and Manila to discuss with the directors the following questions:

(1.) The substitution of Hankow observations for those at Gutzlaff in the Shanghai daily weather telegrams, and of a more westerly station than Nemuro in the list of Japanese reporting stations. Also the possibility of sending the Loochoo observations via Formosa instead of via Tokio.

(2.) The possibility of uniform hygrometric methods and uniform units for weather maps and other publications.

(3.) Adoption by the Japanese Authorities of the Hongkong telegraphic code for daily weather telegrams. This code is used by all the other Weather Bureaus in the Far East.

(4.) A uniform system of wireless time-signals.

The proposals were sympathetically received, but there are difficulties in adopting them which have not yet been overcome.

Staff.—No change occurred in the European Staff. Mr. B.D. Evans, First Assistant, acted as Chief Assistant during the absence on leave of Mr. C.W. Jeffries from June 19 to the end of the year.

Yuen Lai Sang, VIth grade telegraphist, was promoted to Vth grade in the General Post Office on December, 31.

Ip Chun Woo, probationer telegraphist, was dismissed on April 2 and was replaced by Ng Hung Kui, who resigned on August 31. His successor, Lan Sing Tong, resigned on December 31.

Government has been asked to make the scale of pay for these telegraphist-observers sufficient to attract and retain good men.

Expenditure. The annual expenditure on the Observatory for the past ten years is as follows:

Year.	Total Expenditure.	Increase.	Decrease.
	$ c.	$ c.	$ c.
1912	22,595.08	......	757.94
1913	24.255.49	1,660.41	......
1914	25.398.31	1.142.82	......
1915	23.233.12	......	2,165.19
1916	21,977.78	......	1.255.34
1917	26,890.50	4,192.72	......
1918	20,028.24	......	6,862.26
1919	23.450.57	3,422.33	......
1920	25.965.66*	2,515.09	......
1921	32.700.51†	6.734.85	......

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* Increases to European Staff.

† Increases to Local Staff, seismograph and instruments for upper air research.

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T. F. Claxton,
Director.

1922, February 20.